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ABSTRACT

A total of 80 children 4 to 7 years of age participated in a study attempting to establish (1) the frequency of classification performance by age and in relation to available classification criteria, and (2) the degree of preference for different classification criteria by age, particularly differences between figurative and operative criteria. Each child was given eight classification tasks of two choices each. Across the entire task, six criteria were available: four with figurative aspects (color, shape, size, thickness), and two with conceptual aspects (vehicles and habitations). After accomplishing a classification task, subjects were asked to state reasons why he or she had put same things together. Behavior on each task was classified as success or failure to make a classification. Answers of successful subjects were then evaluated on success or failure to explain the classification accomplished, and choice of criteria. Results revealed that children under six years of age were unable to find criteria to make a classification when a concept was involved. They could classify only with some directly perceived figural aspect. It was concluded that findings support the Piagetian position on operative classification abilities of young children and reveal the weakness of positions averring that preoperational children are able to make classifications. (RH)

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EFFECTS OF FIGURATIVE AND OPERATIVE ASPECTS OF A CLASSIFICATION TASK ON PRESCHOOL CHILDREN'S PERFORMANCE

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Piaget and Inhelder (1959) were the first to describe stages in the development of child's classification abilities. They have distinguished three stages in class structuration: 1) stage of figural collections (from 2 to 4 years), 2) stage of non figural collections (from 4 to 7 years) and 3) stage of classification itself or operative classification where the child is able to conceive class inclusion.

Since this work, other studies (Kagan & Lemkin 1961, Suchman & Trabasso 1966, Pierrot Le Bonniec 1972, Meyer 1974, Laflaquière 1979, Melkinan & Al 1981) have tried to enlighten the role of some factors on preschoolers performance in classification. The impact of some figurative aspects as color, shape and size and operative aspects have been studied. These works show in general that criteria were differently used following age. But differences between samples and experiences do not allow yet to conclude about a clear evolutive sequence and the role of figurative and operative aspects during classification development.

With this purpose, we have made a study to establish:

a) The frequency of classification performance by age and in relation with the available classification criteria.

b) The degree of preference of different classification criteria by age and particularly possible differences between figurative and operative criteria.

METHOD

Subjects

A total of eighty (80) children from four (4) to seven (7) years old living in an urban are (Trois-Rivières City) participated in the study.

Sample distribution can be seen on Table 1.

TABLE I

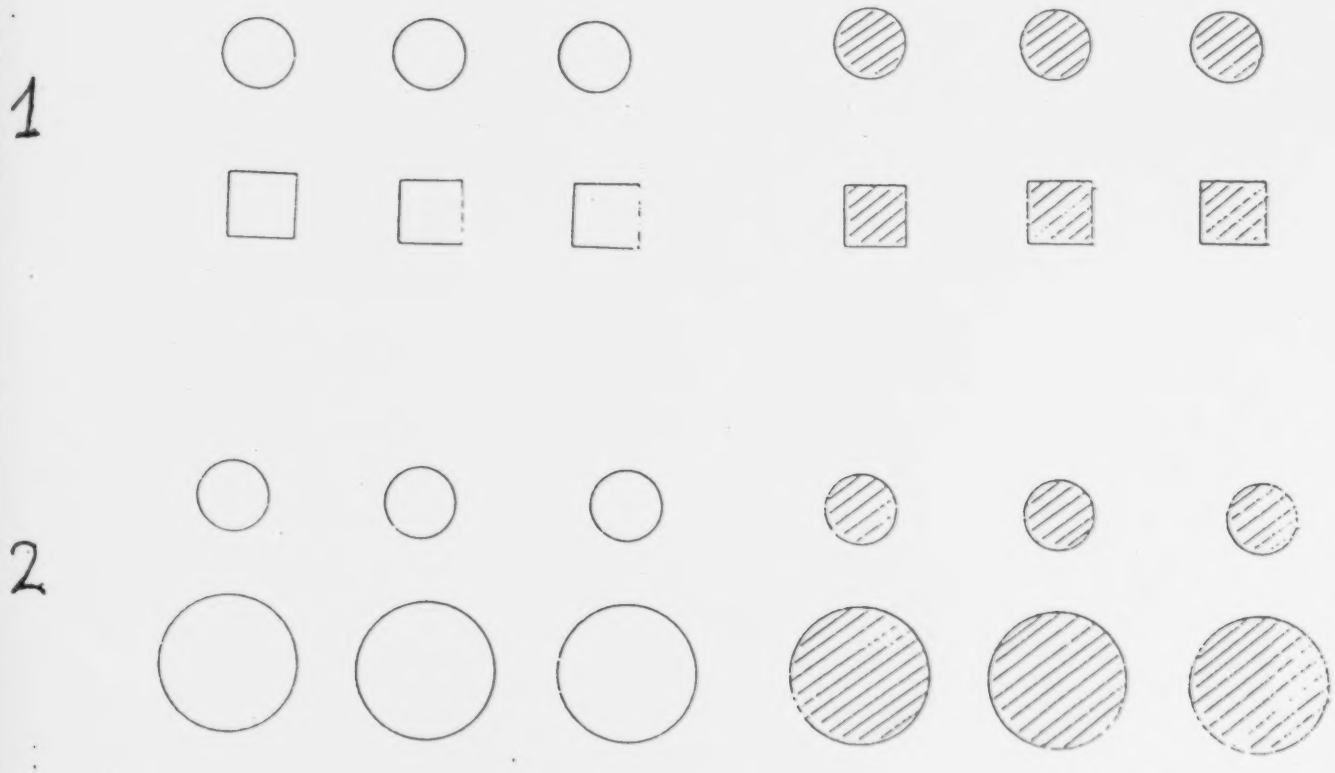
SAMPLE DISTRIBUTION

Age groups	females		males	
	N	M age(months)	N	M age(months)
4	10	53	10	53
5	10	67	10	65
6	10	77	10	77
7	10	90	10	89

Procédure

Each child realizes eight classification tasks. In each one, only two classification criteria were available. Through the whole task, six criteria were available: four criteria referring to figurative aspects (color, shape, size, thickness) and two others referring to conceptual aspects (vehicles and habitations). Discription of material used in each task is shown in figure 1.

Figure 1



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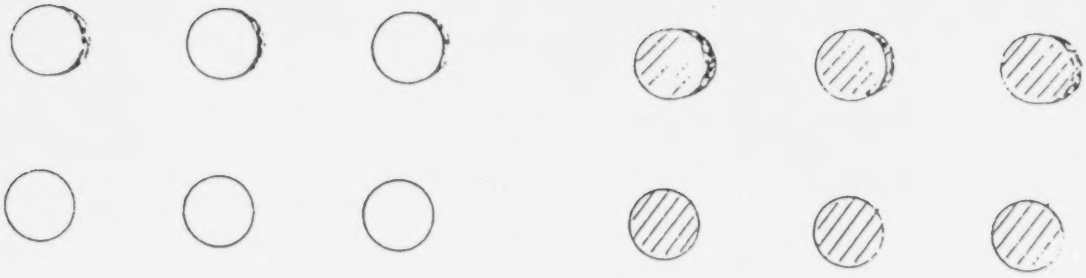

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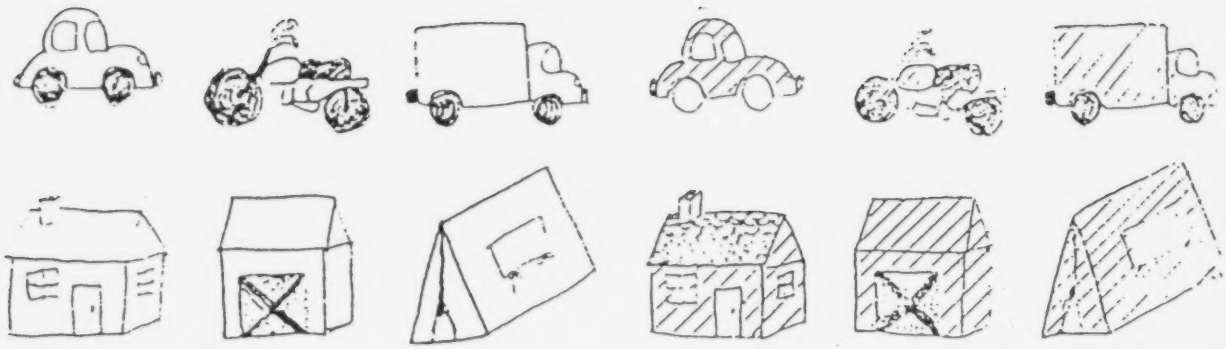

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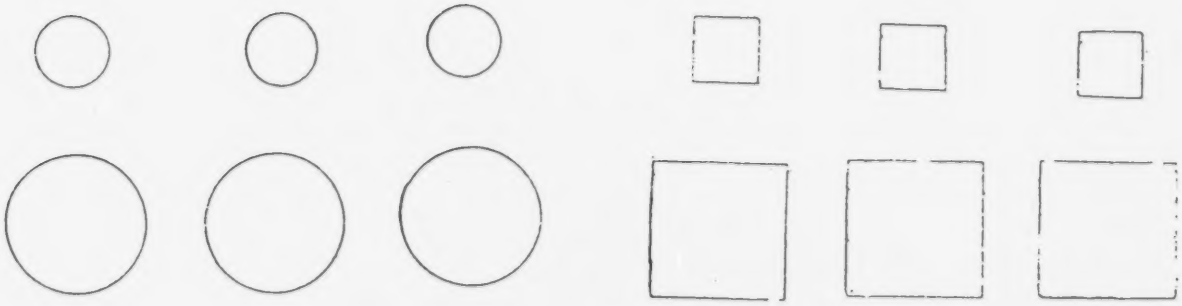

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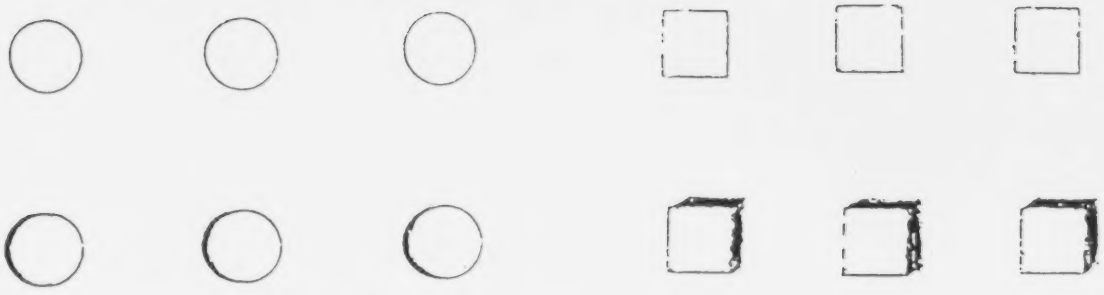

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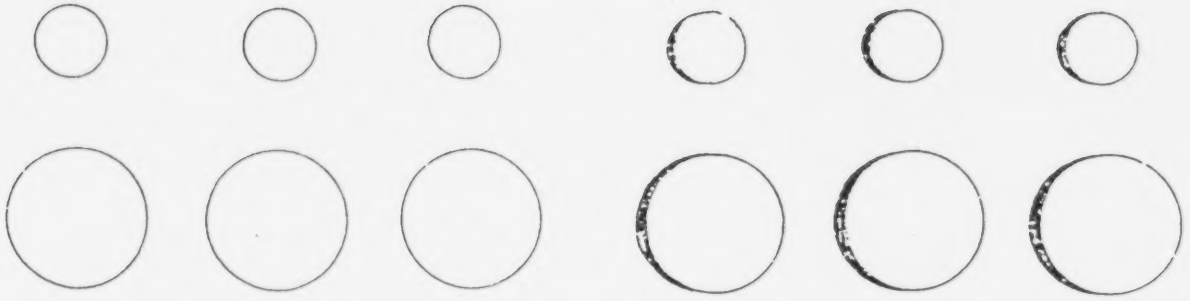

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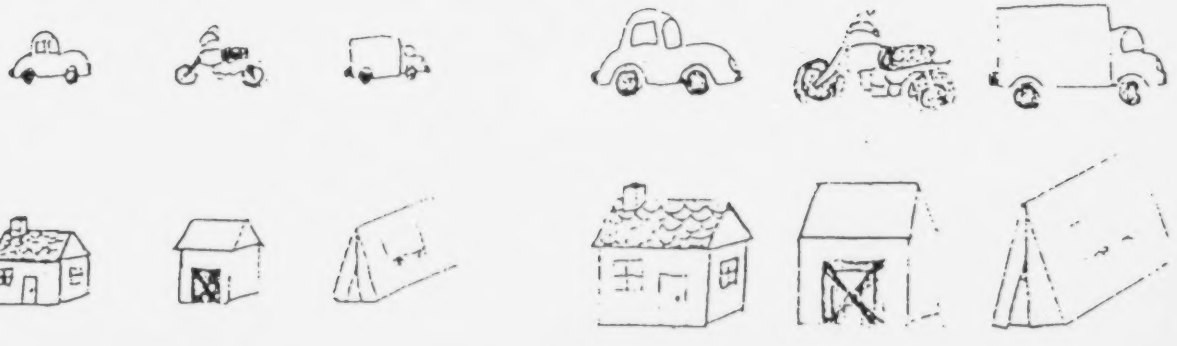


To avoid learning effects, the 8 tasks were presented in different random order to each child. Each child was met individually by the same examinator. While presenting the material for each task, the examinator made sure that the child recognized correctly each object. Then he asked the child: "Make two piles with these things. Put together the things that go well together, that have something similar".

After accomplishing the task, the child was asked to explain reasons why he had put same things together, which means to put into words the reasoning about the choice of criteria.

Behavior on each task was classified first as success or failure to make a classification. Successful answers were then evaluated on two aspects:

1) Success or failure to explain the classification accomplished;
2) Choice of criteria.

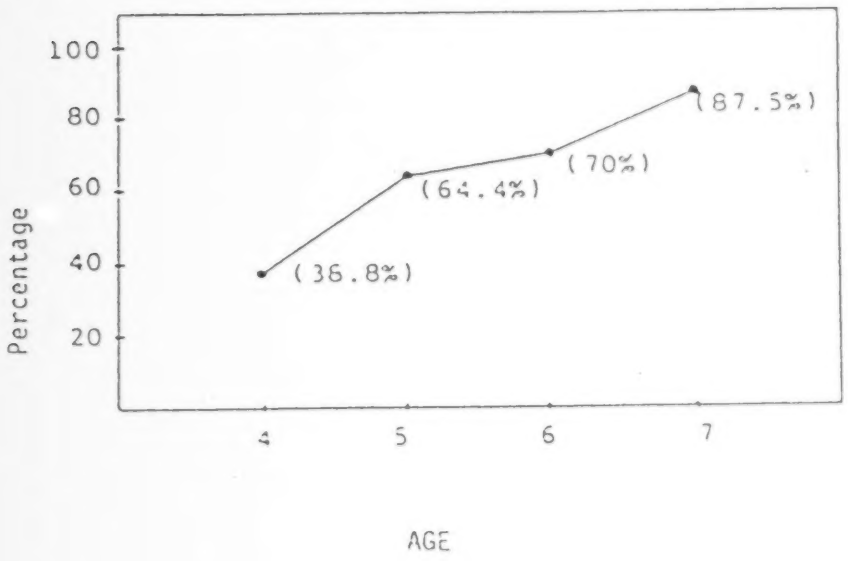
RESULTS

At all ages, each child who was able to accomplish the task could also explain it correctly. Consequently we will see only one series of results concerning success.

As expected, only a low percentage of four years old children succeed in making a classification and percentage of success increases with the age (see table II). The greatest differences appear between the period of 4 to 5 years and of 6 to 7 years.

TABLE II

PERCENTAGE OF CLASSIFICATORY SUCCESS BY AGE



Let us see now the results for each task.

TABLE III

PERCENTAGE OF CLASSIFICATORY SUCCESS AT EACH TEST BY AGE

TESTS \ AGE	4	5	6	7	P.T.
	N=20	N=20	N=20	N=20	N=80
1 color-shape	75%	95%	85%	95%	87.5%
2 color-size	55%	90%	85%	90%	80.0%
3 color-thickness	60%	80%	90%	95%	81.3%
4 color-concept	10%	30%	45%	75%	40.0%
5 shape-size	40%	70%	70%	85%	66.3%
6 shape-thickness	45%	80%	80%	95%	75.0%
7 size-thickness	25%	60%	80%	100%	66.3%
8 size-concept	---	10%	25%	65%	25.0%
TOTAL	38.8%	64.4%	70%	87.5%	

We see first that there is an important difference in the degree of difficulty between tasks. Tasks 4 and 8 where a concept is one of the available criteria have a very low percentage of success (40% and 25%). On the contrary, tasks having only figural aspects as available criteria have a high degree of success. The most successful tasks were those having color as available criteria (tasks 1, 2 and 3).

If we look now at the percentagesa obtained at each age, we see that 4 year olds succeed ratherly well in tasks where they can use color as a classification criteria and a little less in tasks with other perceptual criteria, but they are completely unsuccessful in tasks where a conceptual aspect is present. They do not even succeed to use color as criteria when it is combined with a concept.

Percentage of success increases in 5 and 6 years old children in every task but expecially in tasks 5, 6 and 7 (tasks involving shape, size and thickness).

Finally 7 year olds are the only ones that have a good performance in tasks involving the use of a concept (4 and 8).

We have seen up to now the degree of success in each task, we shall see now what have been the spontaneous choices of criteria made by children (Table IV) and if a significant preference is shown for the use of some criteria (Table V). (Chi-square between frequencies of the choice of attributes had been calculated to test nul hypothesis).

TABLE IV

FREQUENCY OF ATTRIBUTES' CHOICE IN EACH TEST BY AGE

attributes \ age	4		5		6		7		P.T.	
	F.A.	F.R.	F.A.	F.R.	F.A.	F.R.	F.A.	F.R.	F.A.	F.R.
1 color/	7	46.7%	8	42.1%	5	29.4%	3	15.8% **	23	32.9% **
shape	8	53.3%	11	57.9%	12	70.6%	16	84.2%	47	67.1%
2 color/	9	82.0% *	9	50.0%	12	70.6%	7	38.9%	32	57.8%
size	2	18.0%	9	50.0%	5	29.4%	11	61.1%	27	42.2%
3 color/thickness	10	83.3% *	13	81.2% *	15	83.3% **	10	52.6%	48	73.8%
	2	16.7%	3	18.8%	3	16.7%	9	47.4%	17	26.2% ***
4 color/concept	2	100% ****	6	100% ****	9	100% ****	8	53.3%	25	78.1%
	-	---	-	---	-	---	7	46.7%	7	21.9% **
5 shape/size	8	100% ****	11	78.6% *	14	100% ****	13	76.5% *	46	86.8%
	-	---	3	21.4%	-	---	4	23.5%	7	13.2% ***
6 shape/thickness	9	100% ****	14	88.0% **	13	81.2% *	15	79.0% *	51	85.0%
	-	---	2	12.0%	3	18.8%	4	21.0%	9	15.0% ****
7 size/thickness	4	80.0% *	9	75.0% *	13	81.2% *	13	65.0%	39	73.6%
	1	20.0%	3	25.0%	3	18.8%	7	35.0%	14	26.4% ***
8 size/concept	-	---	2	100% ****	1	20.0% **	2	15.4% **	5	25.0%
	-	---	-	---	4	80.0%	11	84.6%	15	75.0% *

* $p \leq .05$
** $p \leq .01$
*** $p \leq .001$
**** $p \leq .0001$

TABLE V

CHI-SQUARE BETWEEN FREQUENCIES OF ATTRIBUTES CHOICE IN EACH TEST BY AGE

attributes		ages 4	5	6	7	total
color-shape	X^2	0.066	0.473	2.882	8.894	8.228
	P	N.S.	N.S.	N.S.	..	..
color-size	X^2	4.455	0	2.882	0.888	1.562
	P	.	N.S.	N.S.	N.S.	N.S.
color-thickness	X^2	5.333	6.25	8.0	0.053	14.785
	P	.	.	..	N.S.	...
color-concept	X^2	2.0	6.0	9.0	0.066	10.125
	P	....	.....	.....	N.S.	..
shape-size	X^2	8.0	4.57	14.0	4.765	28.70
	P	....	.	....	.	...
shape-thickness	X^2	9.0	9.0	6.25	6.37	29.40
	P	....	..	.	.	...
size-thickness	X^2	< 4.76 >		6.25	1.8	11.79
	P	.		.	N.S.	...
size-concept	X^2	----	2.0	< 8.0 >		5.0
	P	----	....	..		.

NS: not significant

. $p \leq .05$
.. $p \leq .01$
... $p \leq .001$
.... $p \leq .0000$

In task 1, seven year old children use significantly more shape than color as a classificatory criteria. Four, five and six year olds use either color or shape. In task 2, four year olds use color significantly more than size as criteria. No significant difference of choice of criteria is shown by 5, 6 and 7 year olds.

In task 3, 4, 5 and 6 year old children use color significantly more than thickness. Seven year olds on the contrary use color and thickness as a criteria in the same proportion.

In task four, 4, 5 and 6 year olds are completely unable to use concept, the few successfull classifications were made with color as criteria. Seven year old children, on the contrary, use either color or concept as classification criteria.

In tasks 5 and 6, we see that shape is significantly more used than size and thickness at all ages.

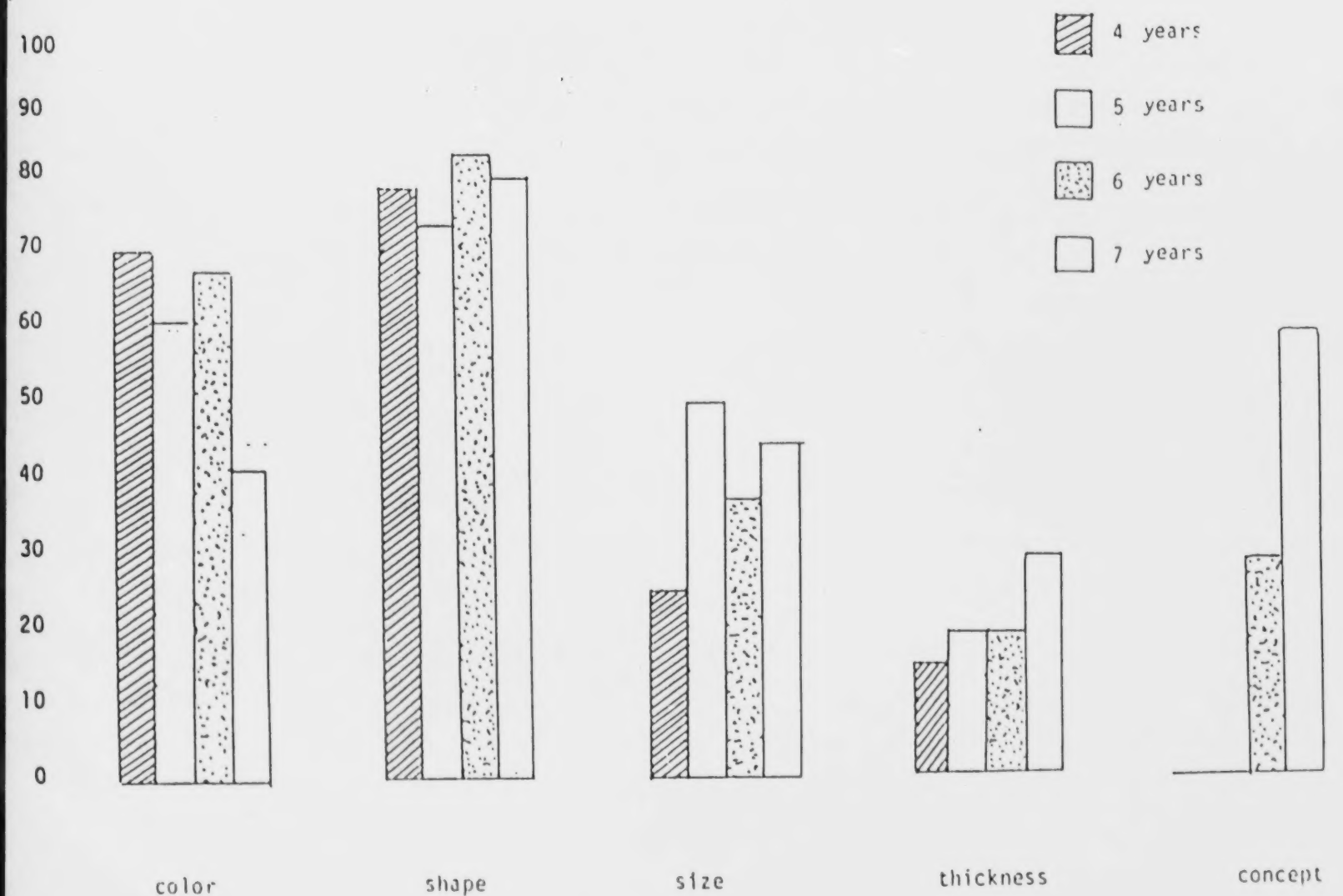
In task 7, we see that all children use size more than thickness as a criteria. This tendancy is less marked on seven year old children (the difference is not significant).

Finally, in task 8, we see that 4 and 5 year olds are completely unable to use a concept as criteria and few 6 year olds begin to use concept. Seven year olds, on the contrary, use concept more than size as a criteria.

To analyse more clearly the data, we can see now the histogram of frequencies of the choice of attributes by age for all tasks together (Figure 2).

We can see first that shape seems the more appealing attribute at all ages. Color is used a lot by young children. But 7 year olds use less color than size and concept. Finally thickness seems the less appealing attribute.

HISTOGRAM OF FREQUENCIES OF ATTRIBUTES' CHOICE BY AGE



CONCLUSION

All these results show that children under six are not able to find a criteria to make a classification when a concept is involved. They can make classification only with some figural aspects; that means that they are not able to construct the criteria, they can only use a criteria when it is directly perceived.

These findings support the piagetian position about operative classification abilities on young children and reveal the weakness of positions avering that preoperatory children are able to make classifications.

We thing that, to avoid concept confusion, we should speak about pre-classification abilities on preoperatory children.

That is because, even if preschoolers make classifications in the current sense of the word, what did they make as cognitive process is a perceptual matching. This preclassification ability is certainly an important prerequisite step in the development towards classification itself.

Our data allows also to see that a hierarchy appears in the choice of perceptual pre-classification criteria.

Shape is the most used criteria at all ages and the only one that doesn't present differences of preference through the ages. On the contrary, preference for using other criteria varies with age. Four to six year old children will prefer more the use of color, the next criteria is the size.

Thickness is used very little. Seven year olds used as much color as size to make classifications. Thickness is less used but the difference with the use of other criteria is lesser than the one shown by younger children.

We have shown also that seven year olds prefer to use a conceptual aspect as criteria even when figural aspects as color, size and thickness are available.

They also use more difficult perceptual criteria (25 size and thickness) even when more easy criteria (as color) is available.

That means that in the course of development, when children acquire new cognitive abilities, they are inclined to put them in action even if it is not strictly necessary to do it.

Finally, we have to emphasize the fact that there is synchrony between the ability to make a pre-classification or a classification and the linguistic capacity to explain it. Positions affirming that linguistic reasons enable preschool children to succeed in some classification tasks are consequently refuted.